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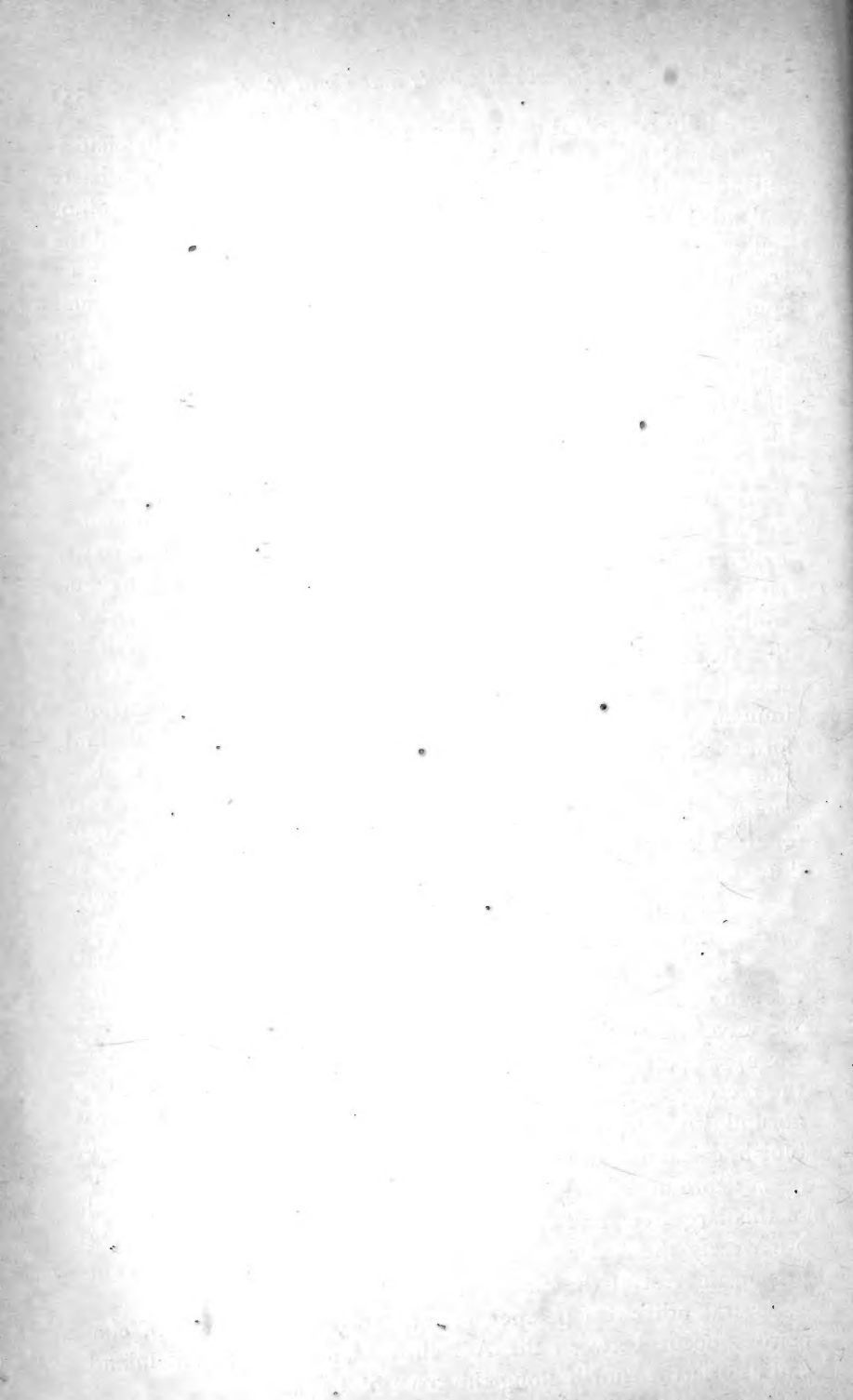


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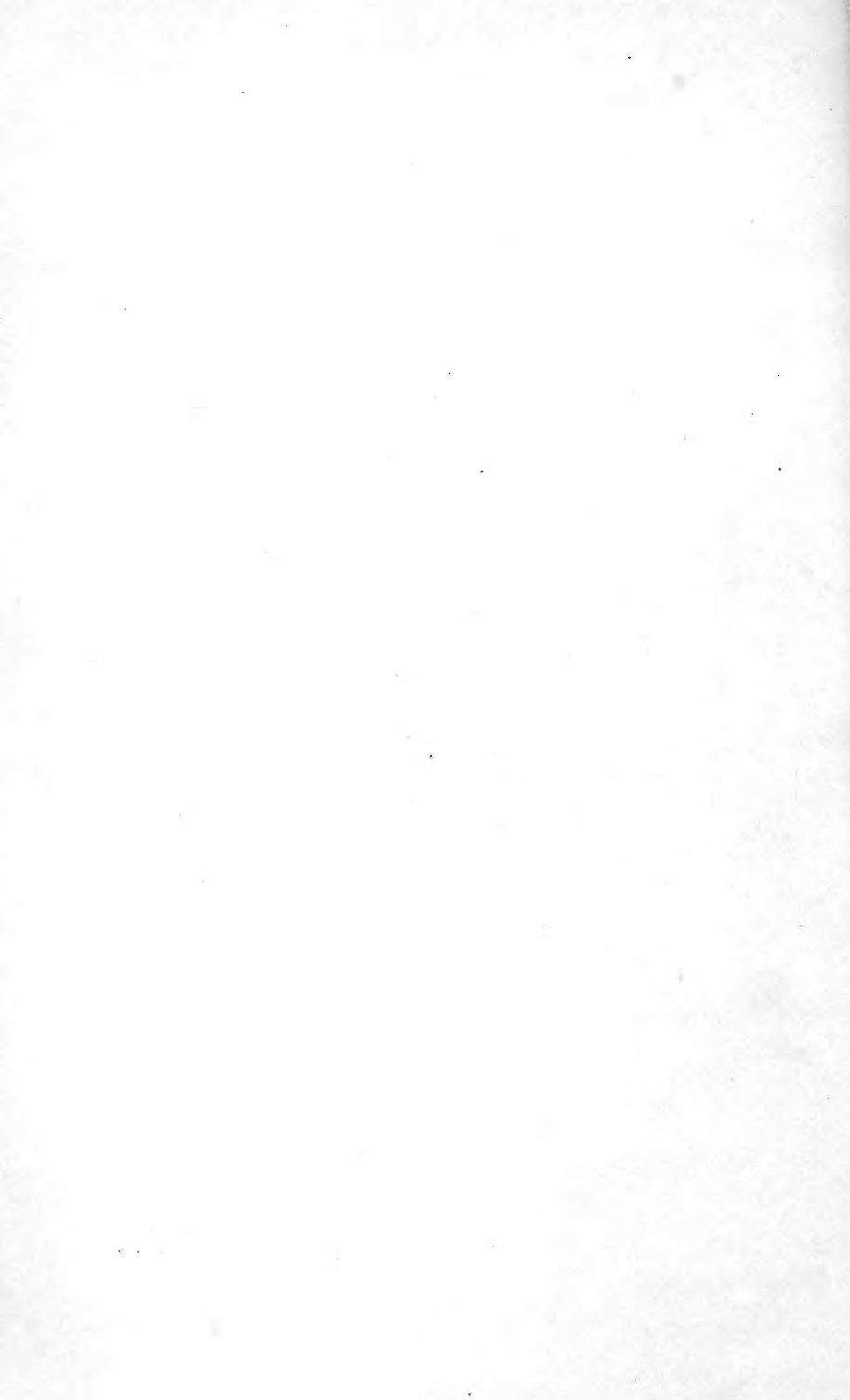
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A LIST OF THE  
BRAZILIAN ECHINODERMS,  
WITH NOTES ON THEIR DISTRIBUTION, ETC.

By RICHARD RATHBUN,  
Assistant on the United States Fish Commission.

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## A LIST OF THE BRAZILIAN ECHINODERMS, WITH NOTES ON THEIR DISTRIBUTION, ETC. BY RICHARD RATHBUN.

THE following list comprises all the species of Echinoderms collected or observed on the Brazilian Coast, by Mr. John C. Branner, the author, and other members of the Geological Commission of Brazil, during the years 1875-77; together with the species hitherto recorded from that region, in the principal works treating of this class of animals.

In accordance with the instructions of the late Prof. Ch. Fred. Hartt, as chief of the Brazilian Survey, collections of marine animals were made at all the sea-coast localities visited by the assistants of the survey, in the course of their geological explorations. The intention was to procure material from as many points as possible, to serve for the study of the geographical distribution of the several species. But the limited time available for zoological work usually rendered it impossible to collect other than the larger and commoner species, the majority of which, at least in the class of Echinoderms, had already been noticed by other travelers, as occurring on the Brazilian coast. Comparatively few additions were therefore made to the previously known Echinoderm-fauna of Brazil, only a single species, a *Leptasterias*, being with certainty new to science. One important result of these researches, however, was the more careful determination of the range and exact habitats of many of the species, and this, together with the fact that no complete list of the Brazilian Echinoderms has yet been published, has been deemed a sufficient reason for the preparation of the present list.

Except in a few instances, lists of synonymy have been omitted; the authority is always given for the occurrence of the species at the localities recorded—in the cases of the Geological Commission and the Hartt Expeditions it is the name of the collector, otherwise generally the publisher. Mr. Alex. Agassiz's "Revision of the Echini" is taken as the sole authority for all the localities given in the list of that group, excepting where the species were also collected on the private expeditions of Prof. Hartt, or by the Geological Commission. The other authorities used throughout the paper will be understood by reference to the list of bibliography which precedes

the lists of species. I am to be held responsible only for the identification of the species collected by the Geological Commission; beyond this the work is entirely a compilation. To render the list more complete and serviceable, there has been added the extra-Brazilian range of all species not confined to that coast: where a species is widely distributed, the regions inhabited by it are indicated only in a general way; where it has been found at only one or a few localities, these are defined.

In the preparation of this paper, I have been placed under many obligations to Prof. A. E. Verrill, for the use of valuable specimens and books, and for much aid and advice, enabling me to better perfect my work than I could otherwise have done. To Mr. Theo. Lyman I am indebted, for the identification of several of the more critical Ophiurans, and for valuable suggestions in making up the list of species of that group.

The principal publications that have furnished materials for this paper, are as follows, arranged alphabetically, according to the authors:

- Agassiz, Alexander. Revision of the Echini. Illustrated Catalogue of the Museum of Comparative Zoölogy at Harvard College, No. VII, 1872-74.
- Gray, John E. Synopsis of the Species of Starfish in the British Museum. London, 1866.
- Ljungman, Axel Vilh. Om några nya arter af Ophiurider. Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar, No. 6, 1866.—Ophiuroidea Viventia huc usque cognita. Öfvers. af K. Vet.-Akad. Förh., No. 9, 1866.—Förteckning öfver uti Vestindien af Dr. A. Goës samt under korvetten Josefinas expedition i Atlantiska Oceanen samlade Ophiurider. Öfvers. af K. Vet.-Akad. Förh., no. 6, 1871.
- Lütken, Chr. Fr. Additamenta ad Historiam Ophiuridarum, Part II, 1859.—Fortsatte kritiske og beskrivende Bidrag til Kundskab om Söstjerneerne (Asteriderne). Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjöbenhavn, Nr. 15-19, 1871.
- Lyman, Theodore. Ophiuridæ and Astrophytidæ. Illustrated Catal. of the Museum of Comparative Zoology, No. I, 1865.—Supplement to the Ophiuridæ and Astrophytidæ. Illust. Catal., No. VI, 1871.—Zoölogical Results of the Hassler Expedition. Part II. Ophiuridæ and Astrophytidæ. Illust. Catal., No. VIII, 1875.
- Müller (J.) and Troschel (F. H.) System der Asteriden, 1842.
- Perrier, Edmond. Révision de la Collection de Stellérides du Muséum d'Histoire Naturelle de Paris. Archives de Zoologie Expérimentale et Générale, t. iv, Nos. 2 and 3, 1875, t. v, Nos. 1, 2 and 3, 1876.
- Pourtales, L. F. de. Reports on the Results of Dredging, under the Supervision of Alexander Agassiz, in the Gulf of Mexico, by the United States Coast Survey Steamer "Blake." (Crinoids). Bulletin of the Museum of Comparative Zoölogy, vol. v, No. 9, 1878.
- Selenka, Emil. Beiträge zur Anatomie und Systematik der Holothurien. Zeitschrift für Wissenschaftliche Zoologie, Leipzig. Vol. xvii, 1867.

Verrill, A. E. Comparison of the Tropical Faunæ of the East and West Coasts of America. Transactions of the Connecticut Academy of Arts and Sciences, vol. i, part II, 1867.—Notice of the Corals and Echinoderms collected by Prof. C. F. Hartt, at the Abrolhos Reefs, Province of Bahia, Brazil, 1867. Trans. Conn. Acad., vol. i, part II, 1868.

## HOLOTHURIOIDEA.

### *Chirodota rotiferum* Stimpson.

Amer. Jour. Sci., xxix, p. 134, 1860; Verrill, Trans. Conn. Acad., i, p. 371, 1868; Selenka, Zeitschr. für Wiss. Zoöl., 1867, p. 367 (*rotifera*).

Abrolhos Reefs (Hartt, '67). Plataforma, Bay of Bahia, buried in the sandy mud of tide pools (Rathbun). Florida (Pourtalès).

### *Thyone* (*Sclerodactyla*) *Braziliensis* Verrill.

Trans. Conn. Acad., i, p. 370, 1868.

Abrolhos Reefs, under dead corals, in the shallow tide pools and holes in the reefs (Hartt, '67). Plataforma, Bay of Bahia, buried in the mud or impure sand, filling the pools and crevices of the rocky shores (Rathbun).

### *Thyonella*, Sp.

Plataforma, Bahia (Rathbun), associated with *Thyone Braziliensis*.

This species of *Thyonella* resembles very closely in external appearance and characters *T. gemmata* Verr.,\* of the Southern coast of the United States, with which it might readily be united, except for the very different nature of its skin-plates. These are mostly of one kind, corresponding nearly with the larger, elongate plates of *T. gemmata*. They are large and flattened, and irregularly fusiform, oblong or even triangular in outline, with generally two, sometimes more, rows of large openings. At times the openings are irregularly scattered and of smaller size. In addition there are more rarely slender, curved plates, with two or three perforations at each end and in the middle, or with a row of perforations.

### *Holothuria*, Sp.

Plataforma, Bahia (Rathbun), associated with *Thyone Braziliensis*.

A specimen of this species, in alcohol, but not much contracted, measures in length, about 125<sup>mm</sup>, greatest diameter, about 24<sup>mm</sup>. The

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\* *Thyonella gemmata* Verr., Amer. Jour. Sci. and Arts, III, vol. iii, p. 437, 1872.

*Colochirus gemmatus* Pourtalès, Proc. Amer. Ass. Adv. Sci., 1851, p. 11.

*Thyonidium gemmatum* Selenka, Zeitschrift für Wissenschaftl. Zoöl., vol. xvii, p. 345, 1867.

skin is nearly smooth, of a brownish yellow color, and with two rows of large purplish brown spots along the dorsal side, and many smaller, darker spots scattered promiscuously, but most numerous on the lateral and dorsal surfaces. The skin is further covered with a net-work of fine reticulations of slight purplish color, giving it a tessellated appearance. A narrow line of the same color extends through the middle of the interambulacral spaces.

The ambulacral zones are of sub-equal width, and about two to three times as broad as the intervening spaces. The suckers are moderately abundant, slightly more numerous in the median ventral than in the other zones, but without regular arrangement, except toward the posterior extremity, where there are two rows to each zone; near the middle of the body, about four to five range across each zone. Around the anus there are five clusters, each of five to eight, more or less pointed papillæ.

The plates of the skin (with suckers) are very numerous, and of several very distinct kinds. The commonest kind is the smallest; minute, flattened, regularly oblong-elliptical in outline, with six small, elongate perforations, arranged in two rows. Four other kinds are common: (1.) A larger, heavier plate, with the margin forming four strong lobes, to each of which corresponds a large, circular perforation, each lobe in turn being usually divided into two or three smaller lobes, bearing a large rounded tubercle; two or three similar tubercles occur between the perforations. This plate may be much enlarged, the number of perforations increasing in proportion. (2.) A table-shaped plate, smaller than the last, and composed of a narrow, upper rim of a squarish outline—a square, with slightly curved sides and rounded corners—pierced at each corner by an oval hole, or seldom with a complete circle of perforations; and four legs, which begin just within the corner perforations, and bend strongly inward for one-half their length, to where they are banded together; below this they are straight, and closely joined at the base, leaving only a small central perforation, surrounded by ten to twelve pointed, divergent tubercles. (3.) A slender, flattened, elongated plate, bulging strongly outward on both sides at the center, and tapering slightly to the ends, which are also enlarged and rounded; on each side of the center there is an elongated perforation, and the rounded ends have one to three small holes. This plate is sometimes broadened and bears a row of perforations along one-half or all of one side. (4.) A rather small cage or basket-shaped plate, of nearly globular form, coming probably from the suckers.

## ECHINOIDEA.

**Cidaris tribuloides** (Lam.) Blainv.

Diet. S. Nat., p. 200, 1830; A. Agassiz, Illust. Cat. Mus. Comp. Zoölogy, No. VII, p. 99, 1872.

*Cidaris annulata* A. Agass., Bull. Mus. Comp. Zool., p. 17, 1863.

Fernando de Noronha, very abundant (Branner). Bay of Bahia, a few fragments dredged in about four fathoms (Rathbun). Rio de Janeiro (Mus. Copenhagen). S. Carolina—Florida; West Indies; Gulf of Mexico; Aspinwall; Cape Verde Isls. (A. Ag.).

**Arbacia pustulosa** (Leske) Gray.

Proc. Zool. Soc. London, April, 1835; A. Agass., Illust. Cat., No. VII, p. 92, 1872.

Armação and Ilhas de Maricás, Prov. of Rio de Janeiro (Hartt, Thayer Exp.). Rio de Janeiro, common about entrance to Bay, etc. (Agassiz, Thayer Exp.; Rathbun). Desterro, Prov. of Santa Catharina (F. Müller). Azores; Madeira; Cape Verde Isls.; west coast of Africa; Mediterranean (A. Ag.).

**Diadema setosum** Gray.

Ann. Phil., p. 4, 1825 (*setosa*); A. Agass., Illust. Cat., No. VII, p. 103, 1872.

Fernando de Noronha, abundant (Branner). The distribution of this species is nearly world-wide. West Indies; Gulf of Mexico; Carribbean Sea; Atlantic, Pacific and Indian oceans; mostly confined within the tropics (A. Ag.).

**Echinometra subangularis** (Leske) Desml.

Syn., p. 266, 1837; A. Agass., Illust. Cat., No. VII, p. 116, 1872.

*Echinometra Michelini* Desor, Catal. Rais., 1846; A. Agass., Bull. Mus. Comp. Zoology, p. 21, 1863; Verrill, Trans. Conn. Acad., i, p. 369, 1868.

Fernando de Noronha (Branner). Pernambuco, boring into the sandstone reef, etc. (Geol. Comm.). Island of Santo Aleixo, Pernambuco, boring into trap rock (Branner). Bay of Bahia, very abundant, boring into coral reef, conglomerate, gneiss, etc. (Geol. Comm.) Porto Seguro; Victoria; Guarapary; Campos; Ilhas de Maricás (Hartt and Copeland, Thayer Exp.). Abrolhos Islands (Hartt, 1867; Rathbun). Rio de Janeiro (Agassiz; Geol. Comm.). Desterro (F. Müller).

This species has been found on nearly all the rocky shores of the coast of Brazil, from Pernambuco to Santa Catharina, and probably also ranges to the north and south of these points. It has the power

of boring into many different kinds of rocks, which are sometimes so completely riddled with its holes, that they yield readily to the force of the waves. It is edible, and contributes to the support of the poor fishermen of the coast, where it occurs (Hartt).

S. Carolina—Florida; West Indies; Aspinwall; Cumana; Bermudas; Cape Verde Isles (A. Ag.).

**Strongylocentrotus Gaimardi** (Blainv.) A. Agassiz.

Illust. Cat. Mus. Comp. Zool., No. VII, p. 163, 1872.

Brazil (Jardin de Plantes; Hartt and Copeland, Thayer Exp.). Bahia; Rio de Janeiro (Mus. Copenhagen). Desterro (F. Müller).

**Toxopneustes variegatus** (Lam.) A. Agass.

Illust. Cat., No. VII, p. 168, 1872.

*Lytechinus variegatus* A. Agassiz, Bull. Mus. Comp. Zool., p. 24, 1863; Verrill, Trans. Conn. Acad., i, p. 369, 1868.

Fernando de Noronha (Branner). Pernambuco (Geol. Comm.). Bay of Bahia, common (Hartt, '67; Rathbun). Porto Seguro; Victoria; Armação; Cape Frio (Hartt, Thayer Exp.). Alcobaga, Bahia (Max. zu Neu Wied). Bay of Rio de Janeiro (Agassiz; Rathbun). N. Carolina—Florida; W. Indies; Gulf of Mexico; Bermudas (A. Ag.). This species is said not to be edible (Neu Wied).

**Hipponoë esculenta** (Leske) A. Agass.

Illust. Cat., No. VII, p. 135, 1872.

*Tripneustes ventricosus* Agassiz, Int. Mon. Scut., 1841.

Fernando de Noronha, abundant and of large size; Rio Formoso, common and large (Branner). Florida; West Indies; Yucatan; Cumana; Surinam; Bermudas (A. Ag.).

**Clypeaster subdepressus** (Gray) Agass.

Prod., p. 187, 1836; A. Agass., Illust. Cat., No. VII, p. 101, 1872.

Bay of Bahia, not uncommon on sandy bottoms, and often attaining a large size (Rathbun). Brazil (Castelneau). S. Carolina—Florida; West Indies; west coast of Africa (A. Ag.).

**Mellita sexforis** (Lamk.) A. Agass.

Illust. Cat., No. VII, p. 141, 1872.

Pernambuco (O. A. Derby, 1870, in Mus. Yale Coll.). Bay of Rio de Janeiro, very abundant near Fort Villegagnon, on sandy bottom



(Prof. Emil Selenka, 1877). S. Carolina—Florida; West Indies; Mexico; Bermudas (A. Ag.)

**Mellita testudinata** Klein.

Nat. Disp. Ech., 1734; A. Agass., *Illust. Cat.*, No. VII, p. 141, 1872.

Maranhao (Agassiz, Thayer Exp.; O. A. Derby, 1870). Itaparica and Cannavieiras, Prov. of Bahia (Rathbun). Rio Doce and Itabapuna, Prov. of Espirito Santo (Hartt and Copeland, Thayer Exp.). Vineyard Sound—Florida; Texas; West Indies; Mexico; Cumana (A. Ag.)

**Encope emarginata** (Leske) Agass.

Mon. Scut., p. 47, 1841; Verrill, *Trans. Conn. Acad.*, i, p. 370, 1868; A. Agass., *Illust. Cat.*, No. VII, p. 126, 1872.

Maranhao (Agassiz, Thayer Exp.). Pernambuco and Maria Farinha (O. A. Derby, 1870; Geol. Comm.). Pernambuco (Belval). Bay of Bahia, very abundant on sandy bottoms (Hartt, '67; Rathbun). Rio Santo Antonio (Max. zu Neu Wied). Victoria; Ilhas de Santa Anna (Hartt and Copeland, Thayer Exp.). Rio de Janeiro, very common on sandy shores, near entrance to Bay, etc. (Agassiz, Thayer Exp.; Rathbun). Desterro (F. Müller). S. Carolina—Florida; West Indies; Yucatan; Nicaragua; Cumana (A. Ag.).

## ASTERIOIDEA.

**Asterias Atlantica** Verrill.

*Trans. Conn. Acad.*, i, p. 368, 1868.

Abrolhos Reefs (Hartt, '67). Only a single specimen of this species, the one collected by Prof. Hartt, has been recorded from Brazil. Bermudas; Remedios, Cuba? (Verr.)

**Leptasterias Harttii**, sp. nov.

A very small star-fish, with six rays. Rays elevated, nearly or quite as high as broad, somewhat flattened below, but strongly and regularly arched above, and regularly tapering to rather sharply pointed tips. Disk small, its diameter equal to about one and one-half times the width of the rays near base. Radii as 1:6 nearly, the greater radius of the largest specimen examined being about 19<sup>mm</sup>.

Adambulacral spines rather slender-clavate toward base of ray, but tapering somewhat farther out, placed regularly two to a plate, those of the outer row slightly larger than the inner. Ventral spines

very much broader than the above, but not much longer, clavate in general form, with compressed tips, not arranged regularly in longitudinal rows, but in short, slightly oblique series of two, seldom three, spines. Between the ventral and adambulacral rows of spines the intervening space is very narrow, but the ventral and lateral rows are widely separated. The lateral and dorsal spines are all of sub-equal size, very small and short, about one-half as long as the adambulacral or even shorter, cylindrical, or slightly tapering, and with truncate, rounded ends. First above the ventrals comes a single row of these spines, rather widely separated, and arranged one to a plate, seldom two, with sometimes a short lower row, of six or seven smaller spines, near the middle of the arm. Above the first lateral rows of each side, we can distinguish in all five longitudinal series of spines, including the median dorsal one. In these series the spines are not generally regularly placed, but we can make out a certain arrangement among them. The first series consists usually of two rows of alternating spines, distinct nearly or quite to the tip of arm. The second series, toward the disk, is made up of successive, irregular or slightly curved, transverse rows of four or five spines, with an intervening spine to connect the several rows; farther out the series becomes reduced to a single, irregular, longitudinal row of spines. The median dorsal series is formed of similar transverse rows of about five spines each, arranged irregularly in the shape of a very broad V, with the angle turned toward the disk; toward the tip there are only two or three spines to a group. Near the disk there are many additional spines scattered over the arms, more or less obscuring the above arrangement. The spines of the disk are similar in character to those of the rays, and of the same size or slightly smaller; they are closely arranged but without order.

The major pedicellariæ are very large and numerous, being scattered over the entire surface of the rays and disk. Where perfectly preserved, they are elongate triangular in outline, with strongly curved base, and are about two-thirds as broad as long; they often appear ovate in outline. They vary in size, many being only one-half or two-thirds as long as others. The larger ones equal or slightly exceed the lateral and dorsal spines in length, and are very much broader. Everywhere above the first lateral rows of spines, they are about uniformly distributed, ranging most commonly along the edges of the plates. Between the ventral and lateral rows of spines, they are much more numerous, being especially abundant just above the bases of the ventral spines. They also occur, but more

rarely, between the ventral and adambulacral rows of spines. On the disk they are about as numerous as upon the dorsal side of the arms.

The madreporic plate is small, flattened, rather low down between the arms, and surrounded by a row of spines; it has but few, rather simple convolutions. The openings between the plates, on the inner half of the arm, are rather large; papulæ placed singly. The above description was made from dried specimens.

This species may be readily distinguished by its very small, simple spines, and proportionately very large pedicellariæ; the latter often much exceed the former in size.

Locality: About 30 miles east of Cape Negro, Brazil, lat. 23° 20' S., depth 62 fathoms, gravelly bottom. Brought up on the cable by the telegraph steamer "Norseman."

**Echinaster echinophorus** (Lam.) Perrier.

Arch. de Zool. Expér., iv, No. 3, p. 364, 1875.

*Echinaster* (*Othilia*) *crassispina* Verrill, Trans. Conn. Acad., i, p. 368, 1868.

This species is apparently the most common one of the genus *Echinaster* on the Brazilian coast. Specimens collected at the Abrolhos Islands in 1876, agree perfectly with the types of *E. crassispina*, from the same locality, as described by Prof. Verrill (loc. cit.). The same species also occurs in great abundance at many places in the Bay of Bahia, generally on rocky bottom (Rathbun); on the coast of the province of Pernambuco (Branner); and near the mouth of the Rio Parahyba do Norte (Br.). It undergoes considerable variation, at times approaching the next species enumerated in this list, and the study of a large series of specimens might serve to prove the identity of the two species. It is generally found in slight depths of water, and when living is of a very bright red color. Bahia and Rio de Janeiro (Perrier, in the Museum at Paris from Castelneau). It is extremely doubtful if this species occurs at Rio de Janeiro.

West Indies (Lütken). North America; Yucatan; Central America (Perrier).

**Echinaster sentus** (Say) Lütken.

Vidensk. Meddel., p. 284, 1871.

From the Bay of Bahia, there were procured by the author, in 1876, several specimens of *Echinaster*, which it is impossible to distinguish from authentic specimens of *E. sentus* from Florida and the West Indies. This species does not, however, appear to be common at the former locality. A single specimen of this genus, collected at Per-

nambuco in 1870, by Mr. O. A. Derby, and contained in the Museum of Yale College, approaches more closely to this than any other described species. Its greatest diameter is about 120<sup>mm</sup>, and it has more slender and gradually tapering arms than typical specimens of *E. sentus*. The spines are slightly longer than usual in this species, and number about eighteen in each of the upper median rows from the center of the disk to the tip of the arm. At Rio Formoso, Pernambuco (Branner) were found young individuals of this same variety, associated with more typical specimens of *E. sentus*. Florida; Hayti (Verrill). West Indies (Mus. Yale Coll.).

### **Echinaster Braziliensis** Müll. and Trosch.

Syst. der Asterid., p. 22, 1842.

I have seen only a single specimen that could be referred to this species, as originally described by Müller and Troschel; it was from Rio Formoso, Pernambuco (Branner). Greatest diameter about 80<sup>mm</sup>, arms quite slender, spines very small and arranged in about nine longitudinal rows, the upper median rows of each arm containing 25–30 spines, from center of disk to tip of arm.

Brazil (Müll. and Trosch., in Mus. Berlin). Rio de Janeiro (Perrier, in Mus. Paris, collected by Freycinet, 1822, Gandichaud, 1839, and Castelneau, 1844). This species was not found at Rio de Janeiro by the Geological Commission. The term *Rio de Janeiro* is often used in a general way to designate Brazil, and it is not improbable that the specimens in the Paris Museum came from some other part of the coast. Florida to Rio de Janeiro (Lütken). Puerto Cabello; Jamaica (Verr.),

### **Linckia Guildingii** Gray.

Ann. and Mag. Nat. Hist., vi, p. 285, 1840.

*Linckia ornithopus* (Lütken) Verrill, Trans. Conn. Acad., i, p. 367, 1868.

Rio Formoso, Pernambuco (Branner). Maceio, Alagoas (Hartt, '67). Mar Grande, Bay of Bahia (Rathbun). Abrolhos Reefs (Hartt, '67). So far as known, this species is very rare on the Brazilian coast, only a few specimens having been collected at each of the above localities. Bahia (Perrier, Mus. Paris). Vera Cruz; Guadeloupe; Cape Verde Isls. (Perr.). St. Thomas (Ltk.). St. Vincent (Gray).

### **Pentagonaster semilunatus** (Linck, 1733) Perrier.

Arch. de Zool. Expér., v, No. 1, p. 24, 1876.

*Goniaster cuspidatus* Gray, Ann. Nat. Hist., vi, p. 280, 1840.

Brazil (Perrier, Mus. Paris, from Castelneau).

According to the generally accepted rules of nomenclature, the above name should give place to one of more modern date, and of such there is an abundance in the long list of synonymy arranged by M. Perrier. As, however, he is the authority for the consolidation of several of the species included in that list, and also for the determination of the only specimens that appear to be recorded from Brazil, I prefer to retain here the old name of Linck, which he has revived. Indian Ocean (Müll. and Tr.). China; West Coast of Africa, at Gorée, Sénégal; Bissagos and Cape Verde Isls. (Perrier). Off Charleston, S. C. (*Goniaster Americanus* Verrill).

**Oreaster gigas** (Linn.) Lütken.

Vidensk. Meddel., 1859, p. 64; Verrill, Trans. Conn. Acad., i, p. 367, 1868.

City of Pernambuco, and also at several places in the same province to the north of the city, abundant (Geol. Comm.). Bay of Bahia, abundant nearly everywhere, on sandy bottom, from low-water mark to two fathoms and deeper; Abrolhos Islands; Caravellas Barra (Rathbun). Abrolhos Reefs (Hartt, '67). Bahia (Perrier, Mus. Paris). St. Thomas (Ltk.). West Indies; Barbadoes; St. Vincent (Gray). Hayti; Florida (Verrill).

**Asterina marginata** (Hupé) Perrier.

Arch. de Zool. Expér., v, No. 2, p. 220, 1876.

Brazil; Rio de Janeiro (Perrier, Mus. Paris). Brazil (Müll. and Trosch., Mus. Vienna). Specimens apparently of this species were collected in the Bay of Rio de Janeiro, by Mr. Branner. Sénégal (Perrier).

**Luidia Senegalensis** (Lam.) Müll. and Trosch.

Syst. der Asterid., p. 78, 1842.

*Luidia Marcgravii* Steenstrup, in Lütken, Vidensk. Meddel., p. 43, 1859.

Rio Formoso, Pernambuco, very abundant and often of large size (Branner). One specimen, collected by Mr. Branner, had a greatest diameter of more than 360<sup>mm</sup>; diameter of disk, 51<sup>mm</sup>. All the specimens observed had nine arms. Pernambuco (Derby, '70, in Mus. Yale Coll.). Brazil (Perrier, Mus. Paris). Sénégal; Guadeloupe (Perrier). Jamaica (Browne).

**Luidia clathrata** (Say) Lütken.

Vidensk. Meddel., 1859, p. 37.

Rio de Janeiro (Perrier, Mus. Paris). A young specimen, probably of this species, was collected in Botafogo Bay, Rio de Janeiro; and two larger specimens, agreeing perfectly with the small one from Rio, were obtained in the Bay of Bahia (Rathbun). N. Carolina—Florida; West Indies (Perr. and Verrill).

**Astropecten Braziliensis** Müll. and Trosch.

Syst. der Asterid., p. 68, 1842.

Bay of Rio de Janeiro, common (Rathbun). Brazil (Perrier, Mus. Paris; Müll. and Trosch., Mus. Vienna).

**Pteraster Danæ** Verrill.

Proc. Bost. Soc. Nat. Hist., xii, p. 386, 1869.

Rio de Janeiro? (J. D. Dana, U. S. Exploring Exp.) It has since been dredged on the east coast of Patagonia (Lütken), and it is possible that the Exploring Expedition specimen also came from that region.

## OPHIUROIDEA.

**Ophiura cinerea** (Müll. and Tr.) Lyman.

Illust. Catal. Mus. Comp. Zoology, No. I, p. 27, 1865; Verrill, Trans. Conn. Acad., i, p. 367, 1868.

This Ophiuran is one of the commonest on the northern and central coasts of Brazil; but it has not been recorded from south of the Abrolhos Islands. It is generally found between high and low water marks, under stones in the shallow pools of the rocky shores and coral reefs, in which situations it often occurs in great abundance. The largest specimens obtained were from Fernando de Noronha. One of these afforded the following measurements; diameter of disk, 37<sup>mm</sup>, length of arm, 210<sup>mm</sup>.

Fernando de Noronha; Parahyba do Norte (Branner). Plataforma, Mar Grande, and throughout the Bay of Bahia (Rathbun). Abrolhos Islands (Hartt, '67). Mr. Lyman refers doubtfully to this species an Ophiuran obtained by the Hassler Expedition in lat. 11° 39' S., long. 37° 20' W., depth 75 fathoms. Florida; West Indies; Gulf of Mexico (Lym.). Aspinwall (Verrill).

***Ophiura appressa* Say.**

Jour. Phil. Acad., v, p. 151, 1825; Lyman, *Illust. Cat.*, No. I, p. 34, 1865.

Parahyba do Norte; Rio Formoso, Pernambuco (Branner). Plataforma, Bay of Bahia (Rathbun). Generally found associated with *O. cinerea*. Bahia (Lütken). About the same general distribution as *O. cinerea*.

***Ophiura brevispina* Say.**

Loc. cit., v, p. 149, 1825; Lyman, *Illust. Cat.*, No. I, p. 18, 1865.

Brazil (Ljungman). Florida; Bahamas; St. Thomas (Lyman).

***Ophiura Januarii* (Lütken) Lyman.**

*Illust. Cat.*, No. I, p. 25, 1865.

Rio de Janeiro (Lütken, collected by Prof. Kröyer). Cotinguiba, Prov. of Sergipe (Lütken, collected by Capt. Hygom). Southern Brazil (Ljungman).

***Ophiolepis paucispina* (Say) Müll. and Trosch.**

*Syst. Asterid.*, p. 90, 1842; Lyman, *Illust. Cat.*, No. I, p. 55, 1865; Verrill, *Trans. Conn. Acad.*, i, p. 367, 1868.

Abrolhos Islands (Hartt, '67). One small Ophiuran, dredged in 3-4 fathoms, near the Island of Paqueta, Bay of Rio de Janeiro, appeared to be the young of this species (Rathbun). Florida; West Indies (Lyman).

***Ophioceramias albida* (Ljungman) Lyman.**

*Illust. Cat.*, No. VIII, part II, p. 10, 1875.

Rio de Janeiro Harbor (Hassler Exp.). Atlantic, near Rio de Janeiro (Ljungman, collected by Kinberg). Off the Rio de la Plata, 19-44 fathoms; East Argentina, 34 fathoms; Barbadoes, 100 fathoms (H. E.).

***Ophioceramias Januarii* (Lütken) Lyman.**

*Illust. Cat.*, No. I, p. 62, 1865.

Rio de Janeiro (Lütken, collected by Prof. Kröyer). Off Bahia, 40 fathoms; Cape Frio, 35 fathoms (H. E.). Barbadoes, 100 fathoms; East Patagonia (H. E.).

**Ophionereis reticulata** (Say) Lütken.

Addit. ad Hist. Oph., p. 110, 1859; Lyman, Illust. Cat., No. I, p. 141, 1865; Verrill, Trans. Conn. Acad., i, p. 366, 1868.

Plataforma and Mar Grande, Bay of Bahia, flat rocky shores, under stones, moderately abundant (Rathbun). Abrolhos Islands (Hartt, '67; Rathbun). Rio de Janeiro Harbor; off Cape Frio (H. E.). Northern Brazil (Ljungman). Florida; West Indies; Bay of Cumana; Bermudas (Lyman).

**Ophiocoma echinata** (Lam.) Agass.

Prod. Mém. Soc. Scien. Nat. de Neuchatel, i, 1835; Lyman, Illust. Cat., No. I, p. 81, 1865.

Several specimens of this species, in fine condition, were brought from Parahyba do Norte, by Mr. Branner in 1876. They were obtained from shallow water, near the shore. A medium size specimen measured: diameter of disk, 26.5<sup>mm</sup>; length of arm, 84<sup>mm</sup>. Florida; West Indies; Aspinwall; Bay of Cumana (Lyman).

**Ophiocoma Riisei** Lütken.

Vidensk. Meddelelser, Jan., 1856, p. 14; Lyman, Illust. Cat., No. i, p. 76, 1865.

One large specimen of this species was obtained by Mr. Branner in 1876, from the shore of the Island of Fernando de Noronha. It measured: diameter of disk, 29<sup>mm</sup>; length of arm, 181<sup>mm</sup>. In the characters of its several parts it agreed quite closely with the description of Mr. Lyman (loc. cit.), the differences noted being such as would naturally arise from its increased growth. Florida; West Indies; Bay of Cumana (Lyman).

**Ophiopsila Riisei** Lütken.

Addit. ad Hist. Oph., p. 136, 1859; Lyman, Illust. Cat., No. I, p. 150, 1865.

Northern Brazil (Ljungman). Florida (Lyman). West Indies (Ljung.)

**Ophiothrix violacea** Müll. and Trosch.

Syst. Asterid., p. 115, 1842; Lyman, Illust. Cat., No. I, p. 164, 1865; Verrill, Trans. Conn. Acad., i, p. 366, 1868.

This is one of the most wide-spread of the Brazilian Ophiurans, having been recorded from Parahyba do Norte in the north, to Rio de Janeiro in the south, and from the littoral zone to a depth of at least 35 fathoms. In the Bay of Bahia it is particularly abundant,



being more common there than any other species. It undergoes considerable variation as regards shades of coloration, but is otherwise quite constant in its characters.

Parahyba do Norte; Rio Formoso, Pernambuco; very abundant (Branner). Plataforma, Mar Grande, Mapelle, and nearly everywhere along the shores of the Bay of Bahia; also dredged in about 4 fathoms in front of the city of Bahia (Rathbun). Abrolhos Islands, abundant (Hartt, '67; Rathbun). Near Bahia; lat.  $11^{\circ} 49'$  S., long.  $37^{\circ} 27'$  W. G.; off Cape Frio, 35 fathoms; Rio de Janeiro Harbor, (H. E.). Rio de Janeiro (Lütken, coll. by Prof. Kröyer; Müll. and Trosch., in the Museum at Vienna). Southern Brazil (Ljungman). Florida, shore to 50 fathoms; West Indies; Yucatan (Lym.). Aspinwall; Barbadoes (H. E.).

**Ophiothrix Suensonii** Lütken.

Vidensk. Meddel., Jan., 1856, p. 16; Lyman, Illust. Cat., No. I, p. 157, 1865.

Lat.  $22^{\circ}$  S., long.  $40^{\circ}$  W. G., sandy bottom, depth not recorded; obtained by the Brazilian cable repair steamer "Norseman," 1876, (identified by Mr. Theo. Lyman). West Indies; Carthagera, New Granada (Lyman). Barbadoes, 100 fathoms (H. E.)

**Ophiactis Krebsii** Lütken.

Addit. ad Hist. Oph., p. 126, 1859; Lyman, Illust. Cat., No. I, p. 111, 1865; Verrill, Trans. Conn. Acad., i, p. 366, 1868.

Plataforma, Bay of Bahia, only a few specimens obtained (Rathbun). Abrolhos Islands (Hartt, '67). Near Island of Paqueta, Bay of Rio de Janeiro, 3-4 fathoms, five specimens dredged (Rathbun). The majority of the specimens obtained had six arms. S. Carolina—Florida; Bahamas; St. Thomas (Lyman).

**Ophiactis Mülleri** Lütken.

Addit. ad Hist. Oph., p. 127, 1859; Lyman, Illust. Cat., No. I, p. 109, 1865.

Off the Abrolhos Islands, 30 fathoms (H. E.). Florida; West Indies (Lyman).

**Hemipholis cordifera** (Bosc) Lyman.

Illust. Cat., No. I, p. 137, 1865.

Southern Brazil (Ljungman). S. Carolina (Lyman).

**Amphiura Kinbergi** Ljung.

Vestindiska och Atlantiska Ophiurider, p. 643, 1871.

Southern Brazil (Ljungman).

**Amphiura flexuosa** Ljung.

Oph. Viventia, p. 319, 1866.

Southern Brazil (Ljungman, coll. by Kinberg). Barbadoes, 100 fathoms? (H. E.). Key Biscayne, Fla.? (Lyman).

**Amphiura Stimpsonii** Lütken.

Addit. ad Hist. Oph., p. 116, 1859.

Off Cape Frio, 35 fathoms (H. E.). West Indies (Lyman).

**Amphiura complanata** Ljung.

Oph. Viventia, p. 319, 1866.

Atlantic Ocean, lat.  $22^{\circ} 30' S.$ ; long.  $40^{\circ} 55' W.$  (Ljungman, coll. by Kinberg). Also from northern Brazil (Ljung.)

**Amphiura crassipes** Ljung.

Oph. Viventia, p. 319, 1866.

Atlantic ocean, lat.  $22^{\circ} 30' S.$ , long.  $40^{\circ} 55' W.$  (Ljungman, coll. by Kinberg). Mr. Theo. Lyman has referred doubtfully to this species a single specimen of Ophiuran, obtained in 1876 by the steamer "Norseman," about twenty-five miles south of the entrance to the Bay of Rio de Janeiro, in 45 fathoms. The specimen was too much mutilated to permit of an accurate determination.

**Amphiura tenera** Lütken.

Addit. ad Hist. Oph., p. 124, 1859; Lyman, Illust. Cat., No. I, p. 123, 1865.

Off Cape Frio, 35 fathoms (H. E.). S. Carolina; West Indies (Lyman).

**Amphiura duplicata** Lym.

Illust. Cat., No. VIII, part II, p. 19, 1875.

Brazil? (H. E.). Barbadoes, 100 fathoms (H. E.).

**Amphiura planispina** E. v. Martens.

Monatsbericht der Kon. Akad. Berlin, p. 347, 1867.

Rio de Janeiro.

**Amphipholis Riisei** (Lütken) Ljung.

Oph. Viventia, p. 313, 1866.

Southern Brazil (Ljungman). West Indies (Ljungman).

**Amphipholis Januarii** Ljung.

Om nagra nya arter af Ophiurider, p. 165, 1866.

Bay of Rio de Janeiro (Ljungman, coll. Kinberg).

**Amphipholis subtilis** Ljung.

Oph. Viventia, p. 314, 1866.

Atlantic, near Rio de Janeiro (Ljungman, coll. Lovén).

**Amphipholis limbata** (Grube) Ljung.

Oph. Viventia, p. 314, 1866.

Rio de Janeiro (Lyman). Coast of Brazil (Ljungman).

**Ophiocnida scabriuscula** (Lütken) Lyman.

Illust. Cat., No. I, p. 135, 1865.

Plataforma, Bay of Bahia, near low-water mark (Rathbun,—identified by Mr. Theo. Lyman.) Florida; West Indies (Lyman).

**Ophiocnida Loveni** Lyman.

Bull. Mus. Comp. Zool., i, No. 10, p. 337, 1869.

*Ophiophragmus Lovéni* Ljung., Om nagra nya arter af Oph., p. 165, 1866.

*Amphipholis Lovéni* Ljung., Vestindiska och Atlantiska Ophiurider, p. 648, 1871.

Bay of Rio de Janeiro (Ljungman, coll. by Kinberg). Off the Island of Paqueta, Bay of Rio de Janeiro, 3–4 fathoms, muddy bottom (Rathbun,—identified by Mr. Theo. Lyman).

**Ophiostigma isacanthum** (Say) Lyman.

Illust. Cat., No. I, p. 103, 1865.

Off Cape Frio, 35 fathoms (H. E.). Florida,—63 fathoms; St. Thomas; St. John (Lyman).

**Ophiomyxa flaccida** (Say) Lütken.

Addit. ad Hist. Oph., p. 138, 1859; Lyman, Illust. Cat., No. I, p. 178, 1865; Verrill, Trans. Conn. Acad., vol. i, p. 366, 1868.

Abrolhos Islands (Hartt, '67). Near Bahia (H. E.). Florida,—50 fathoms; West Indies (Lyman).

## CRINOIDEA.

*Antedon carinatus*?

*Alecto carinata* Leach.

*Comatula carinata* Lamarek, Anim. sans Verteb., 2d ed., iii, p. 210, 1840.

*Antedon Dübenii* Verrill (non Bölsche), Trans. Conn. Acad., i, p. 365, 1868 (with?).

Mr. L. F. de Pourtales, in a recent publication,\* refers to *Comatula carinata* Lam., with query, a species of *Antedon* which he states to be common on the Brazilian coast. He does not, however, give the exact localities from which the specimens he has examined were obtained. Only two species of *Antedon* were collected by the members of the Geological Commission. One of these is a small species, with more than ten arms, to be described further on; the other is ten-armed, and from comparisons I have been able to make is evidently identical with the form mentioned by Mr. Pourtales. It was found in abundance at Rio Formoso, Pernambuco, at many localities in the Bay of Bahia, and at the Abrolhos Islands; but probably ranges along the entire coast, at least as far south as Rio de Janeiro. It generally occurs in holes and crevices of the rocky shores, and of millepores and other corals, clinging tightly by means of its cirri, but completely exposing its arms. A single, much mutilated specimen was collected at the Abrolhos Islands, by Prof. Hartt in 1867, and referred doubtfully to *Antedon Dübenii* Bölsche, by Prof. Verrill. Another specimen contained in the Peabody Museum of Yale College, was received from Dr. C. F. Lütken, labeled *Antedon Braziliensis* Lütk., Rio de Janeiro. This is apparently the same as the form now under discussion, and it approaches in many of its characters more closely the *A. carinatus* of the Mauritius and Zanzibar, than do the specimens from northern Brazil.

The Peabody Museum possesses several specimens of *Antedon* from Zanzibar, which, although I found them undetermined, agree so closely with the original descriptions of *A. carinatus*, as to leave little doubt of their identity.\* The Brazilian forms that I have been able to study differ from the Zanzibar specimens about as follows:—The *A. Braziliensis*, above mentioned, has the dorsal side of the arms rather more strongly carinate, the tubercle projecting from the median outer edge of each joint being usually very strongly marked, and often reaching inward one-half to two-thirds the length of the joint, as a very prominent, slightly elongate, sub-angular ridge, with a minutely spinose surface. One or two joints alternate between the

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\* Bull. Mus. Comp. Zoology, Cambridge, v, No. 9, p. 214, 1878.

successive syzygia. In the characters of the cirri and the centro-dorsal piece there are no appreciable differences.

The specimens from Bahia and Pernambuco, on the contrary, differ mostly with regard to the centro-dorsal piece and the cirri. The former is usually proportionately broader and flatter, but is extremely variable. The cirri are, as a rule, proportionally longer and fewer in number; they are placed in about two irregular rows, or in one crowded row, and range in number from about fifteen to thirty, on medium-sized specimens. They are composed of from nineteen to twenty-two joints each. The total spread of the largest perfect specimen observed was a little over twenty-five centimeters. The color varies from a light yellowish brown to a deep violet, with many intermediate shades, specimens being usually banded with lighter and darker colorings, and seldom of uniform tint.

The study of a large series of specimens would probably serve to unite the Brazilian with the East African species beyond all doubt.

**Antedon meridionalis** (A. Ag.) Verrill.

Proc. Bost. Soc. Nat. Hist., vol. x, p. 339, 1866; Pourtales, Bull. Mus. Comp. Zool., i, No. 11, p. 355, 1869; Ibid., v, No. 9, p. 214, 1878.

Charleston, S. Carolina, to Cape Frio, Brazil (Pourtales, Mus. Comp. Zool.)

**Antedon Dübenii** Bölsche.

Archiv. für Naturgeschichte, 1866, p. 92.

Rio de Janeiro (Bölsche).

**Antedon**, sp.

A small species of *Antedon*, having between ten and twenty arms, was collected by Mr. Branner, in great abundance at some locality not definitely recorded, either on the coast of Pernambuco, or of Parahyba do Norte. I have not been able to identify it with any described species that has come under my notice, although it may not be new.

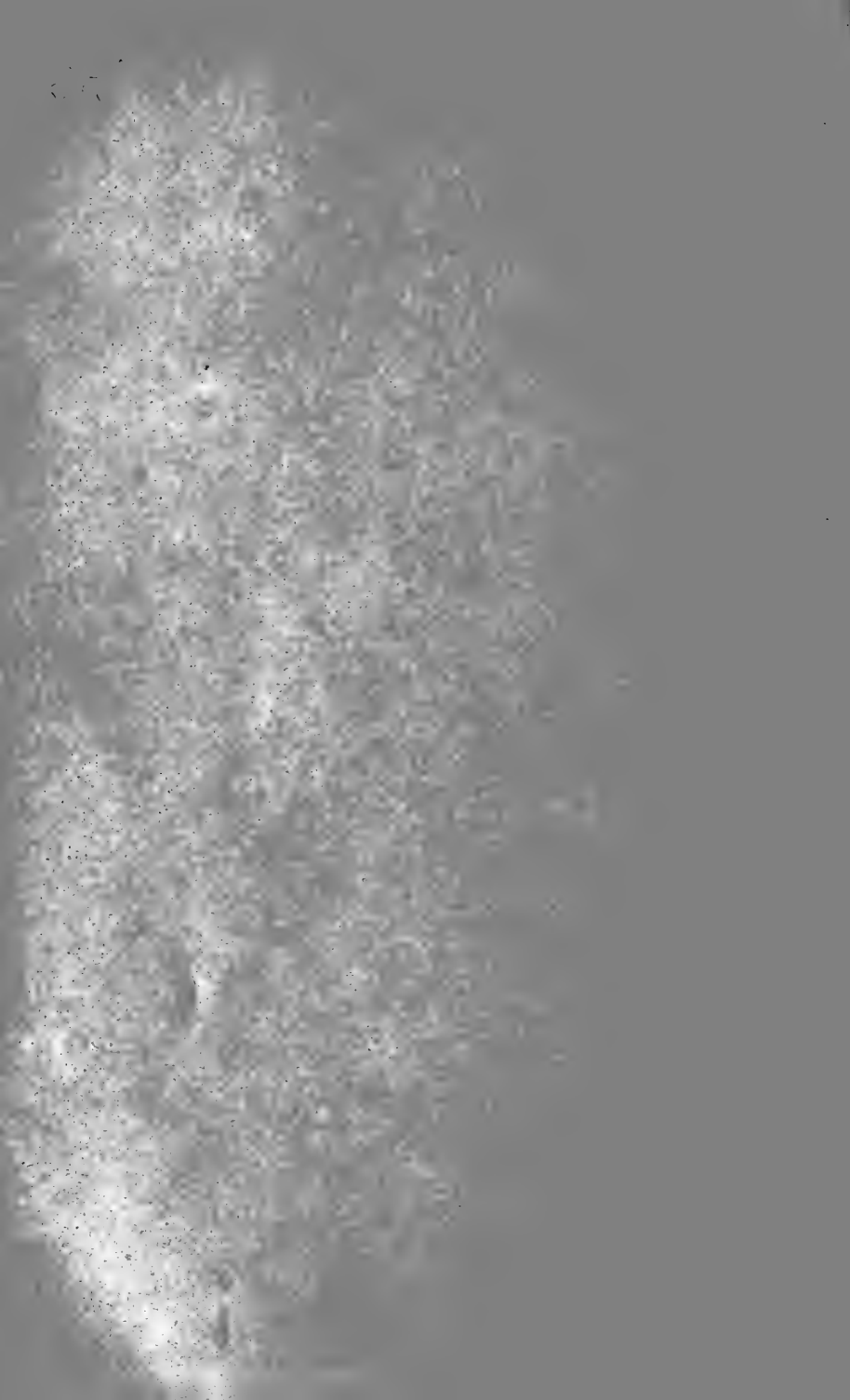
It is rather a delicate species, with slender arms and cirri, the former at times presenting only one division of the second order resulting in the formation of eleven arms. There may, however, be any number of arms, up to at least twenty. It has a total spread of only about 9<sup>cm</sup>, the centro-dorsal piece, measuring 2<sup>mm</sup> in diameter, being flat and destitute of cirri on top, but sometimes still preserving

there traces of their points of attachment. Around the edge of the piece is a single row of twelve to sixteen cirri, each composed of eleven to twelve simple joints, in addition to the large, incurved, sharply-pointed terminal spine. First joint very short; second as long as broad; third to sixth or seventh longer than broad, somewhat constricted toward the centre, or enlarged at the ends, so as to produce a series of swellings along this part of each cirrus; the remaining joints, to the tip, decrease successively in size, and are slightly compressed laterally, the last three bearing each a minute, sharp tubercle at or near the upper distal end.

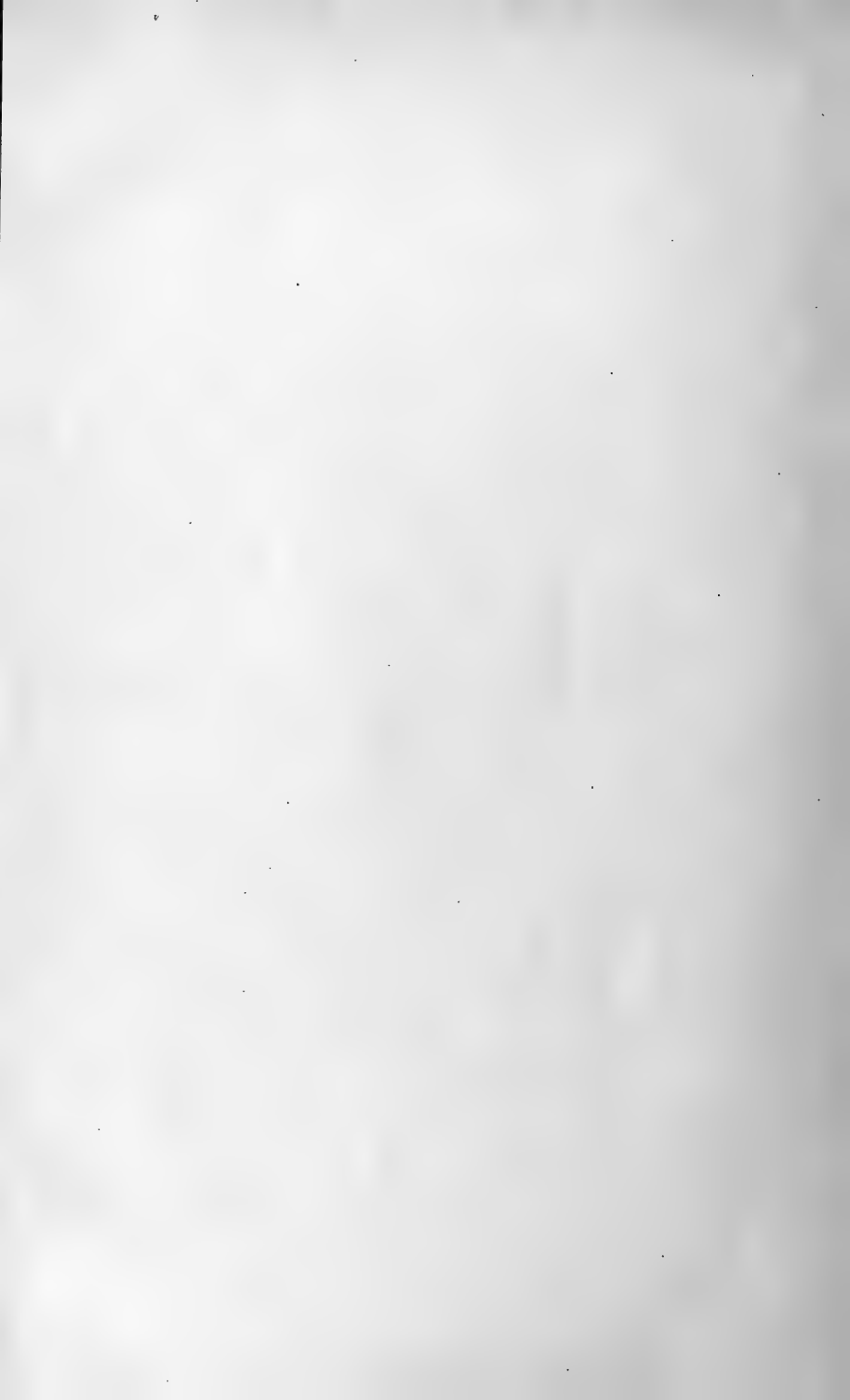
First radial slightly exposed; axials low, pentagonal; usually three brachials between first and second axials, and one brachial between second and third axials, when the latter occurs. At base of arm the joints are simple; but shortly after the last division they become rather long, and well-separated, with an oblique distal edge, which is thin and slightly raised so as to appear imbricating; this edge terminates in a row of minute, sharp tubercles. The first pinnule starts from the second joint after the first division; after the second division, there is a pinnule to each joint on alternate sides, with seldom an intervening joint. The first pinnules are very long and slender, their length being equal to about the diameter of the oral surface of the disk, or slightly greater. They are composed of rather elongated joints, those toward the base having their distal ends, on two sides, thin, slightly elevated and minutely spinose. The last seven to ten—not including the three terminal ones—bear each a very large, irregular tubercle, which is nearly as long as the joint itself. In alcoholic specimens these pinnules curve gracefully over and lie entangled together upon the oral side of the disk, appearing not unlike the young, unfolding fronds of a fern. The second pinnules are similar in structure to the first, but shorter. The others, to tips of the arms, are of subequal size throughout, and from one-third to one-half the length of the first; they are rather broader at the base, and each of the three terminal joints composing them is marked with a minute, sharp tubercle.

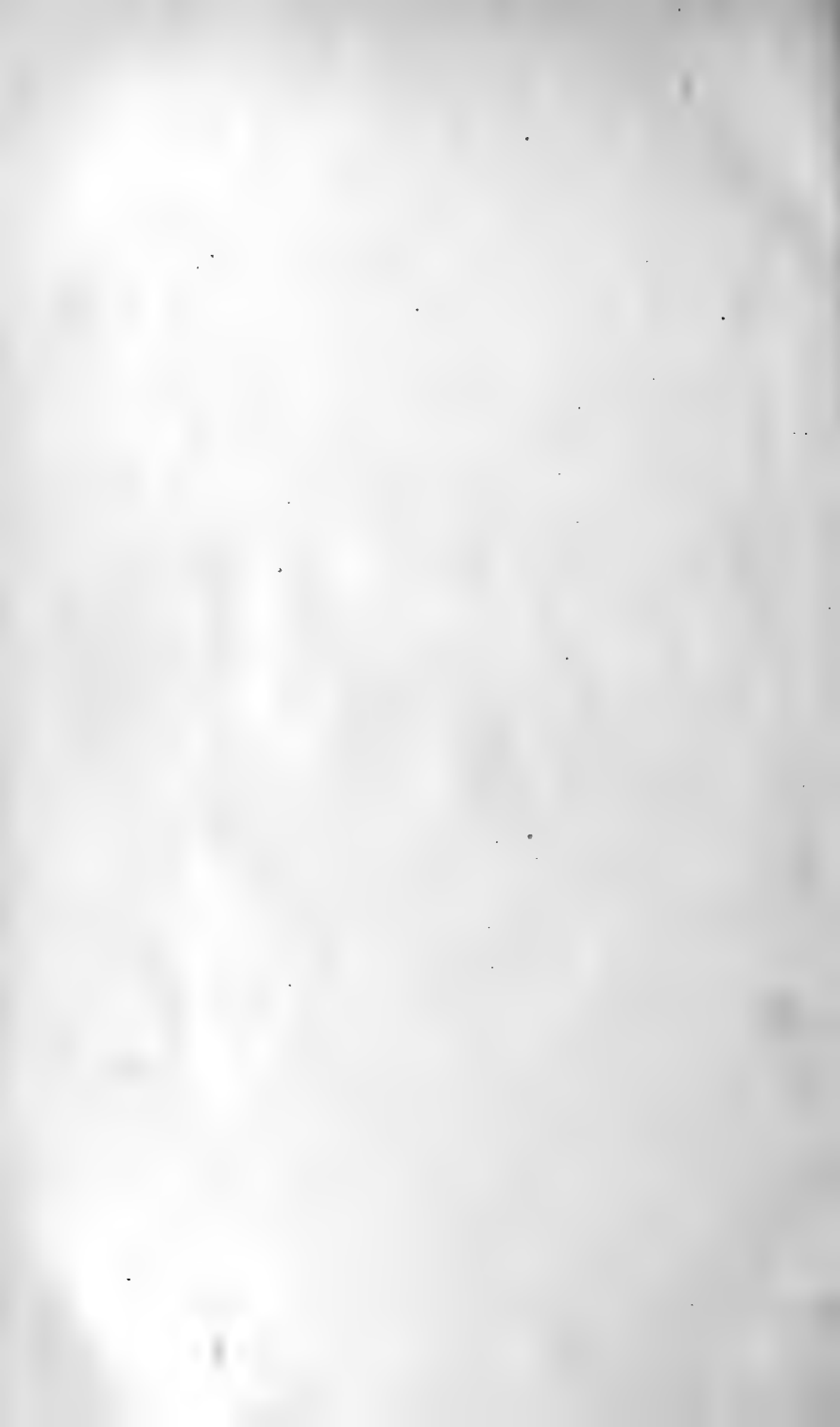
Oral surface very minutely granulose; mouth eccentric; anus nearly central, raised on an elevated, conical prominence.







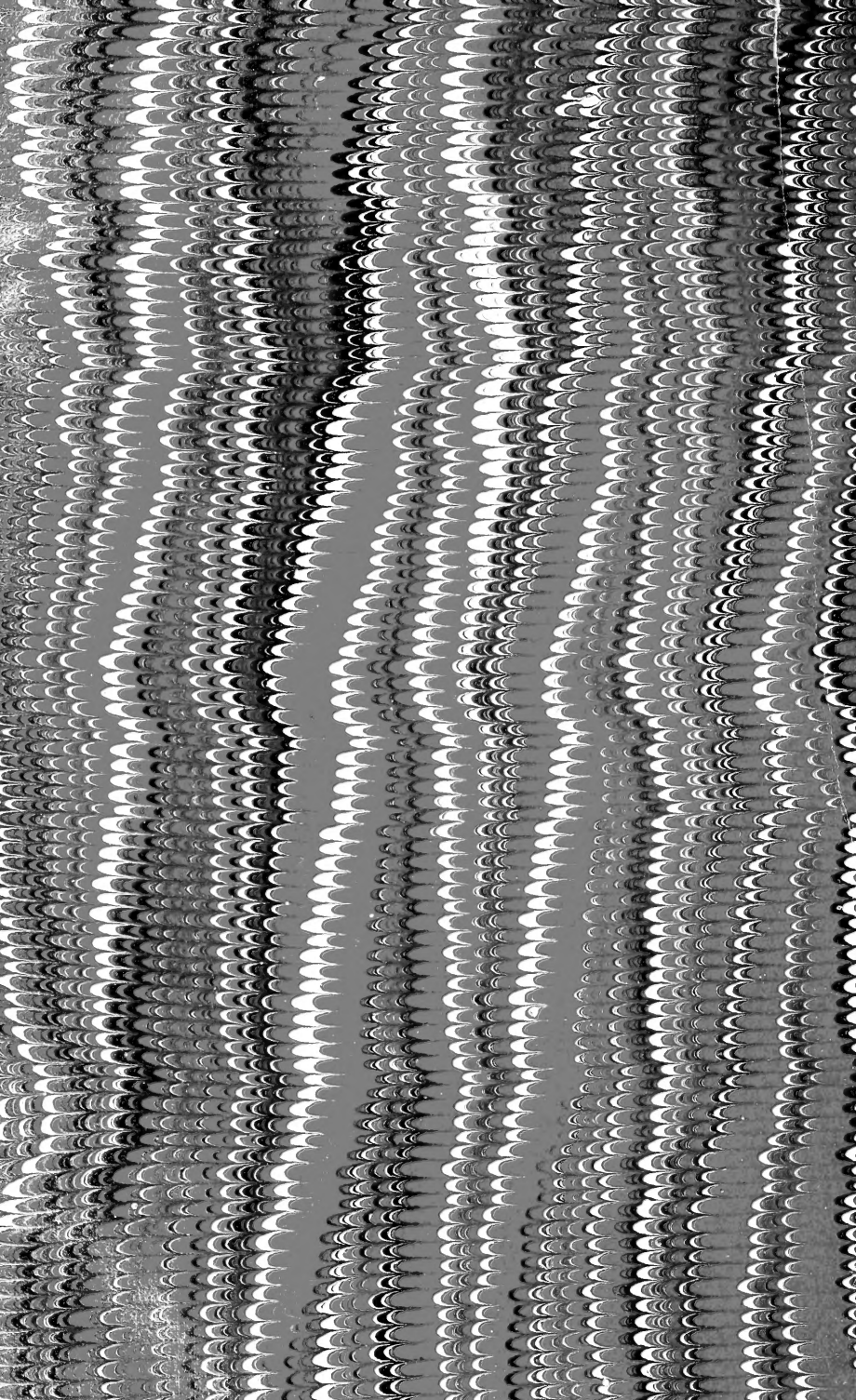


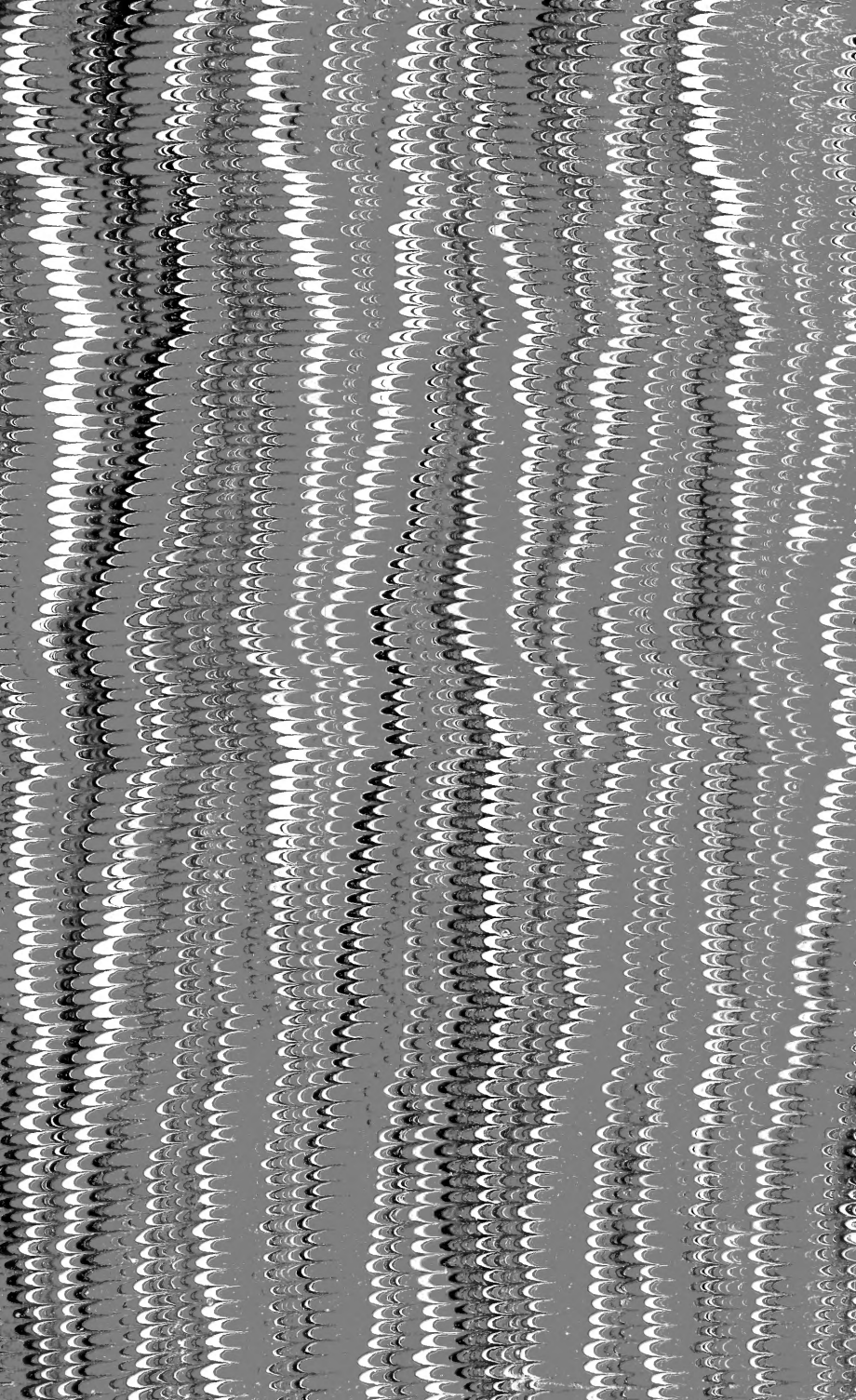












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